

Capital
Delivery

River Humber Gas Pipeline Replacement Project

Engineering Challenges - UKOPA

23rd October 2018

nationalgrid



Location



Existing feeder exposed



The 5km crossing of the River Humber, laid in 1984, is one of the most important pipelines on the NTS. It conveys gas primarily from Easington Terminal into the heart of the England, and provides 20% of Britain's gas at peak demand.



The tidal forces in the Humber Estuary have shifted the river bed and put our assets at risk. Feeder 1 (in the same vicinity) was decommissioned and subsequently failed. Temporary protection measures have been in place on Feeder 9 since 2009.

Options considered

Direct Pipe



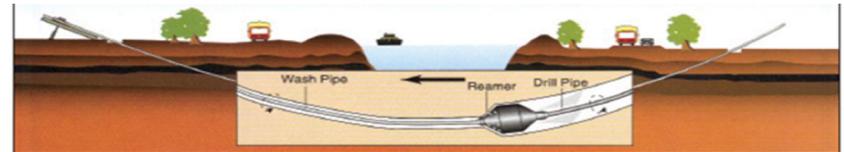
Immersed Tunnel



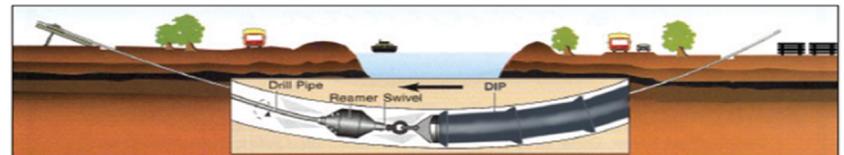
Open Cut



HDD



PRE-REAMING

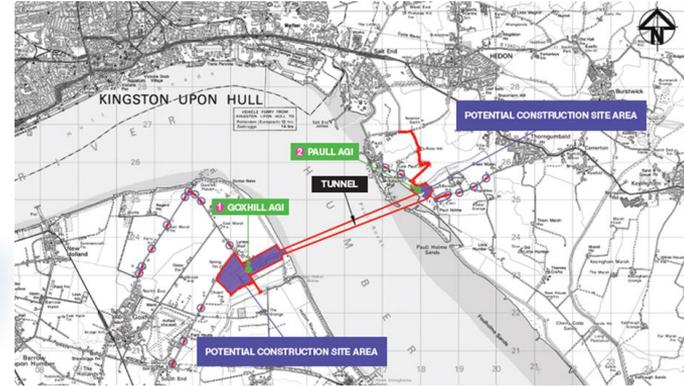


PULL-BACK

Schematics are courtesy of the Directional Crossing Contractors Association

The Solution

Will be the World's longest pipeline river crossing in a tunnel: 5km, 3.65m diameter tunnel, 42" (1050mm) 70 bar pipeline and 0.5km of tie-ins to existing above ground installations.



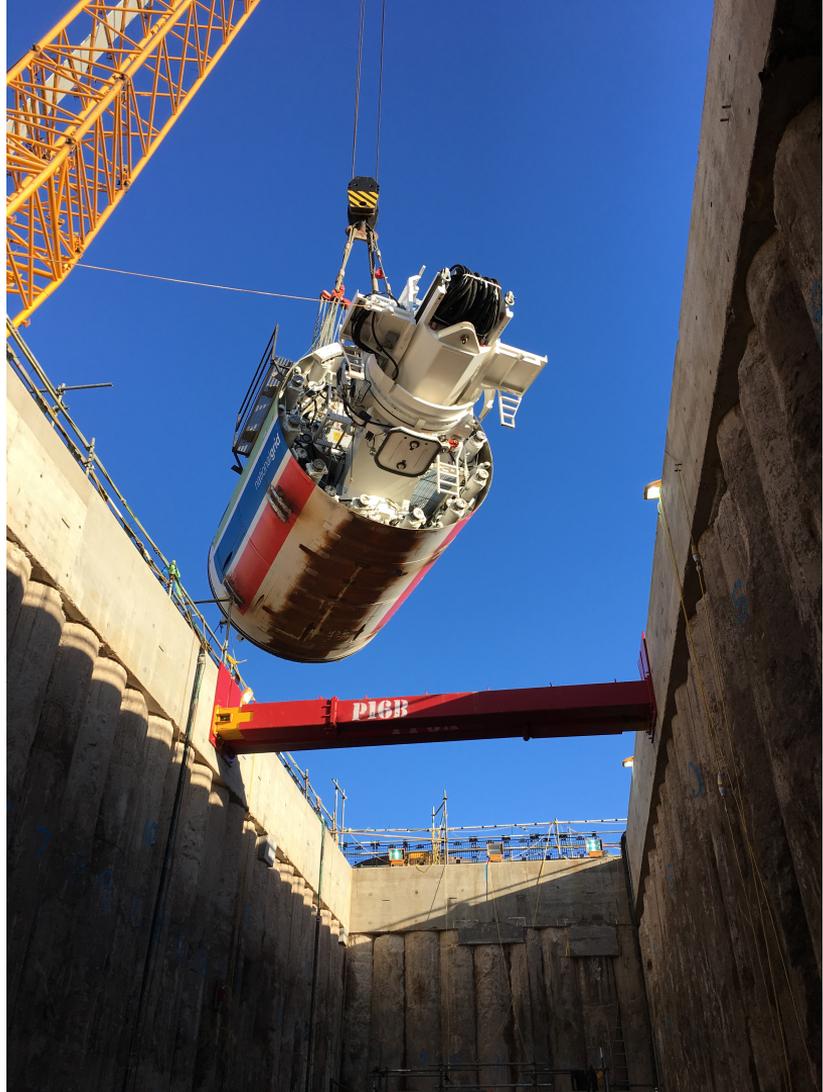
Two reference projects:

- 4km River Ems Crossing between Germany and Netherlands
- 4.2km Santos GLNG Crossing, Queensland, Australia

Technical Challenges:

- Ground conditions for Tunnelling
- Pipeline Insertion
- Pipeline Protection





Environmental designations and constraints

Ramsar Site

Special Protection Area (SPA)

Special Area of Conservation (SAC)

Site of Special Scientific Interest (SSSI)

Migrating Birds wetlands

Paull Holme Strays (RPSB)

Intertidal Mud Flats

Water Voles



Humber Gas Pipeline Replacement Project

Flood Risk and Flooding Impact

The Humber area is predominantly low-lying land with much of it reclaimed from the river. Along with the Humber there are two main watercourses and a network of drainage ditches across both sites. This gives challenges to protect the engineering works and the workforce.

Protection measures include flood walls around infrastructure and the drive pit, and elevated offices



Flood Warning Scheme: EA



Why does this area flood?

A combination of low lying land, tidal flows, and locked-in water leads to cumulative risks of flooding from Groundwater and Surface Water

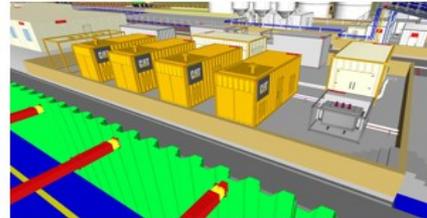
Flood Zone 1: Protected by EA Flood Defence Bunds



Mitigation: Elevated Vulnerable Infrastructure



Mitigation: Flood Walls



2007 Major Floods in Hull – A63



Storm Surge



Surface Water Flooding: N. Lincs



Rural Location



Rural Location



CP effect on tunnel lining

- **CP effect on concrete tunnel identified**
- **Requirement to provide 120 year design life for tunnel**
- **Need to reduce potential of high CP currents**
- **Concrete coated pipe to protect FBE coating**
- **Required 400+ pipes to be Concrete Weight Coated**
- **Increased tunnel pipe from 3,645t to 6,480t**







Significant laydown area required

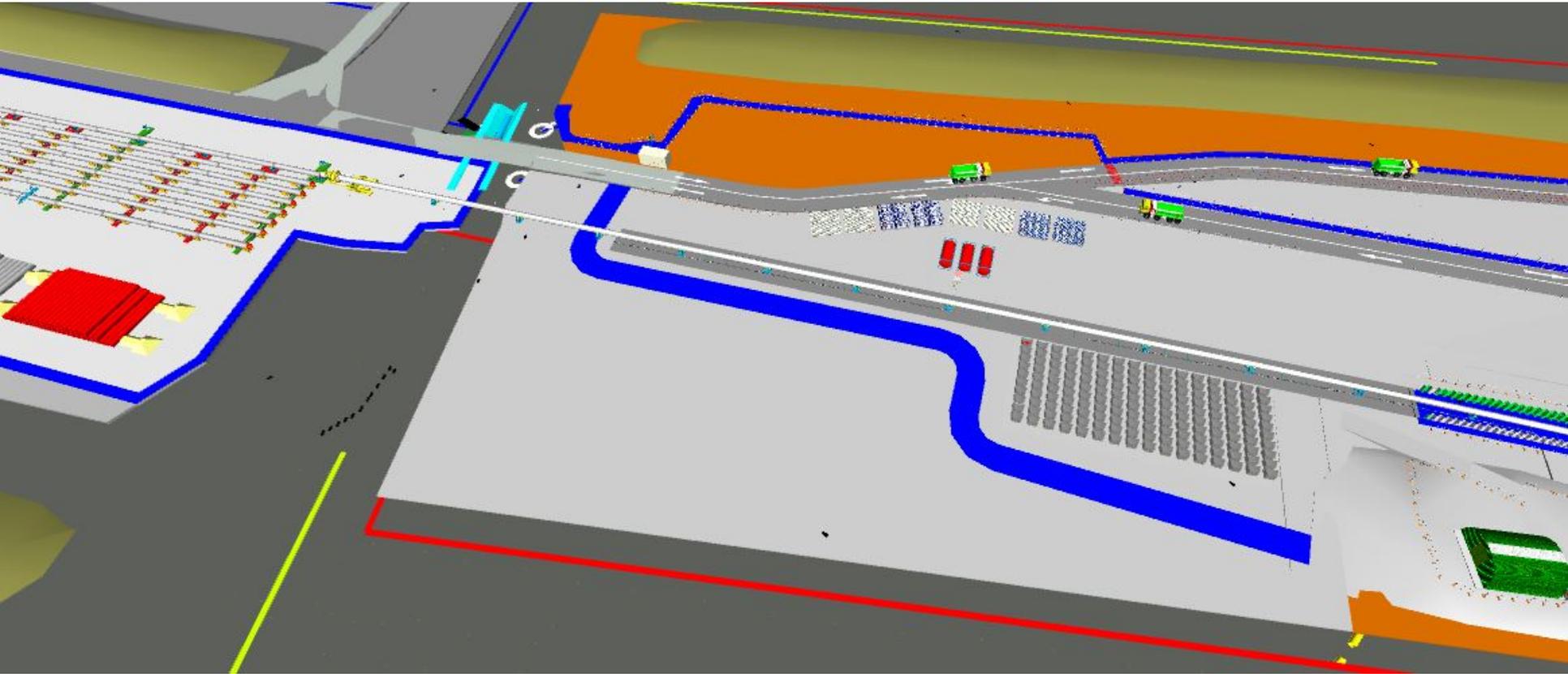


Pipe Insertion

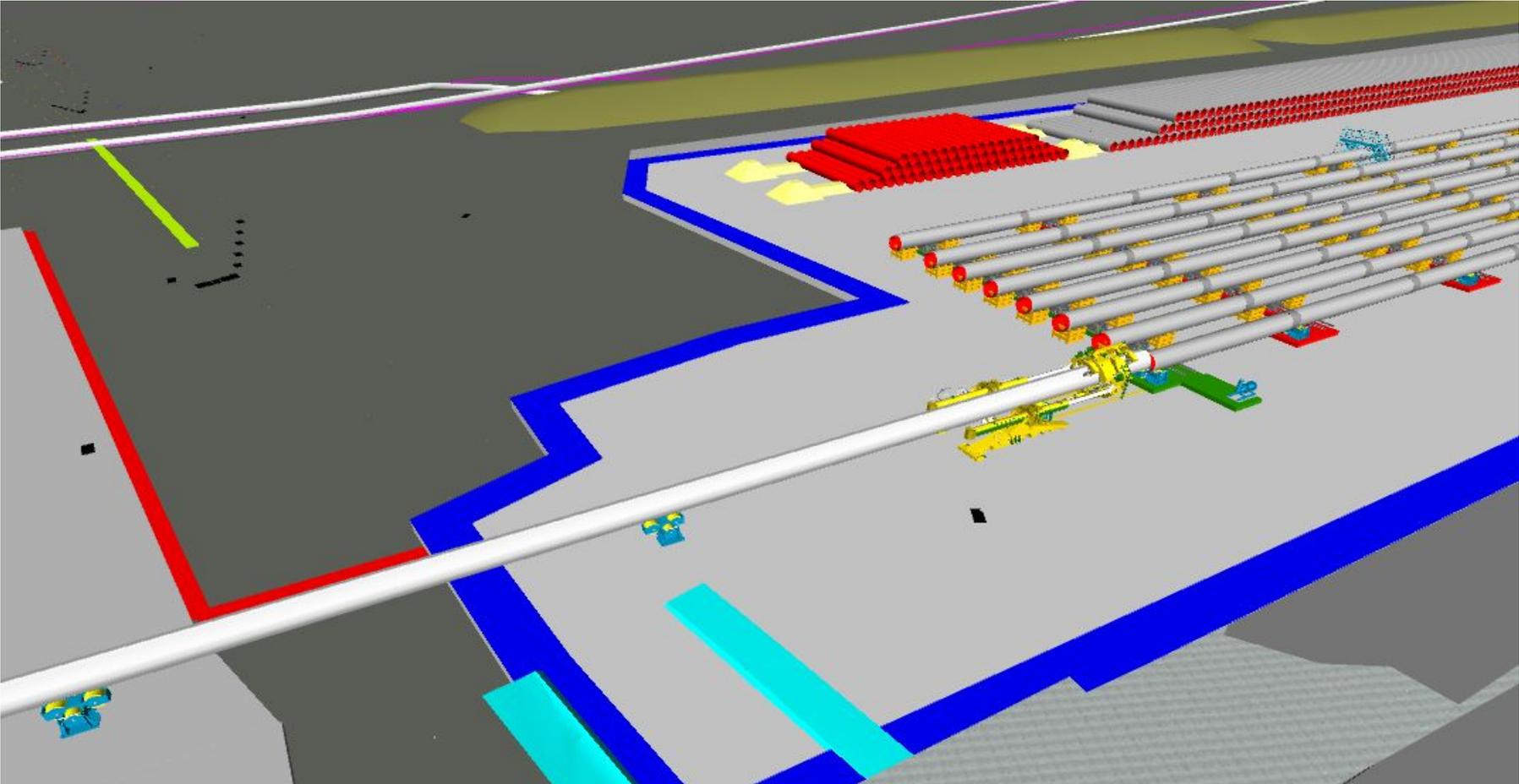


Pipe Thruster 500T

Pipe Insertion



Pipe Insertion



So Far

Successes – what's gone well

DCO delivery

Stakeholder engagement – Local community/Council/EA/HSE

Environmental management

Launch shaft

Pipe stringing/welding

Arisings management

Challenges ahead

Consistent safety performance

Embedding cost reduction

Tunnel productivity

CP/water fill/pipe insertion

Demobilisation

Tunnel – Tunnel Key Facts

Tunnel Key Facts:

- TBM Bore Diameter: 4.40 m
- Shield Weight: 225 t
- Total TBM Weight: 510 t
- Tunnel Inner Diameter: 3.65 m
- Segment Thickness: 225 mm
- Segment Length: 1,200 mm
- Tunnel Length: 4,862 m
- Number of Segments: 4,052
- Reinforced Concrete Mass: 33,300 t
- Excavated Soil Mass: 190,000 t



Pipeline Key Facts

Pipeline Key Facts:

- Pipeline Length: 5.4km (4.86km tunnel)
- Nominal: ID – 42”
- Grade: X65
- Pipe Weight: 16 t per pipe
- Pressure: 70 bar
- Number of Pipes: c.405
- Strings for Insertion: 8 (c.624m)
- Pipe string: 832 t
- Complete string: 6,480t



Any Questions



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